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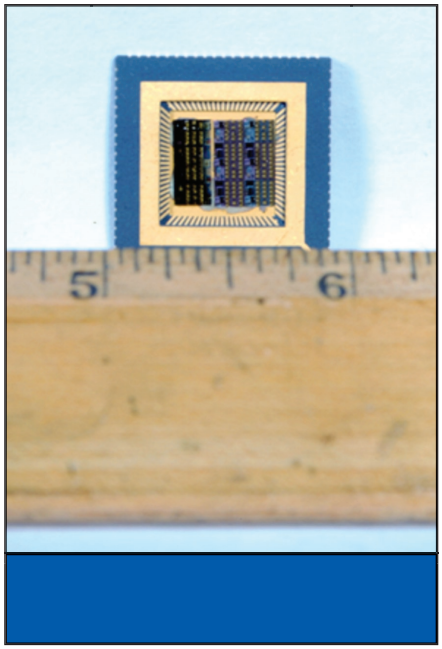
Science and Technology for Tomorrow's Air and Space Force

Success Story

NEW PHASE SHIFTER ESA FOR SPACE-BASED AND UNMANNED COMBAT AIR VEHICLE SENSORS



Sensors Directorate scientists helped design, build, and demonstrate a new type of phase shifter via a Dual Use Science and Technology program. This new shifter gives two times the bandwidth and two times the phase shift of earlier designs, resulting in about 1 GHz of useful bandwidth centered at 9.2 GHz and 100º of phase shift (37º of scan in the E-plane).

A low-loss, low-cost, low-power, low-weight phase shifter concept, integrated into an Electronically Scanned Antenna (ESA) composed of revolutionary radiating elements, achieved the elevation scan. These phase shifters have potential application in a low-cost, flat profile, X-band, one-dimensional (1-D) ESA that is suitable for space-based and unmanned combat air vehicles. In addition to these benefits, the flat profile makes the ESA an excellent candidate for a conformal fit to the skin of the aircraft, thus mitigating the need for a radome.

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Accomplishment

This new phase shifter is a low-cost, low-power consumption, reciprocal phase shifter capable of achieving electronic antenna scans in 1-D. Directorate scientists demonstrated the new ESA in several configurations in the laboratory including 1-D electronic scan in the E-plane using the basic configuration and 2-D electronic scan achieved by integrating an active Transmit/Receive (T/R) module like those feeding into the basic ESA.

Background

ESAs, distinct from Mechanically Scanned Antennas, are desirable for a number of reasons including reliability and performance. However, conventional ESAs based on T/R module technology are very expensive and require complex beam steering electronic/computers and substantial prime power. Technologies that reduce the number of T/R modules and thus reduce the antenna cost, weight, and power consumption with minimal performance impact are an active area of research.

Unmanned air vehicles are substantially smaller than conventional combat and surveillance aircraft and require lighter and lower cost radar. The warfighter, however, still requires a high-performance, all weather surveillance and targeting platform. This technology has applications to space-based radar with potential benefits of improved radar reliability via the removal of an electromechanical gimbal as well as performance enhancements via precision electronic beam scanning and low antenna manufacturing costs.

Sensors
Emerging Technologies

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (02-SN-12)